OPERATION & MAINTENANCE

HANDBOOK

Ref:
GE P.O 036-713-50341

MODEL P903

PLUG-IN OUTPUT UNIT

PER S.O. 121/5562 & EO 2364

DATAPULSE®

A SUBSIDIARY OF SYSTRON-DONNER CORPORATION

OPERATION & MAINTENANCE

HANDBOOK

Ref:
GE P.O 036-713-J0341

MODEL P903

PLUG-IN OUTPUT UNIT

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DATAPULSE
DIVISION OF DATAPULSE INCORPORATED
509 HINDRY AVENUE, INGLEWOOD, CALIF.

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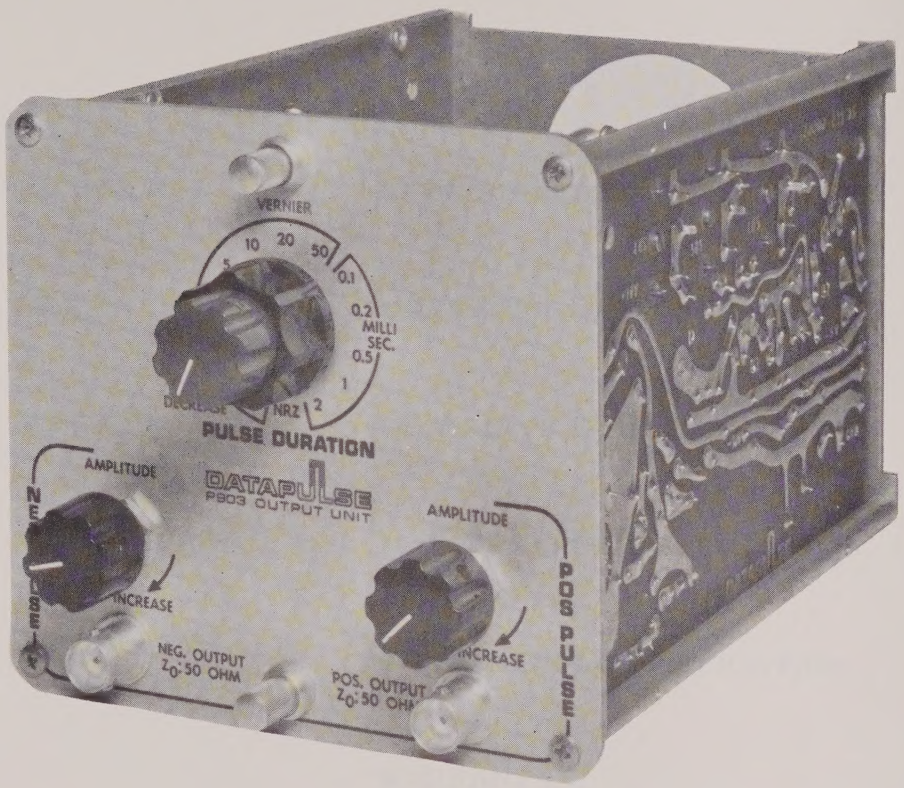
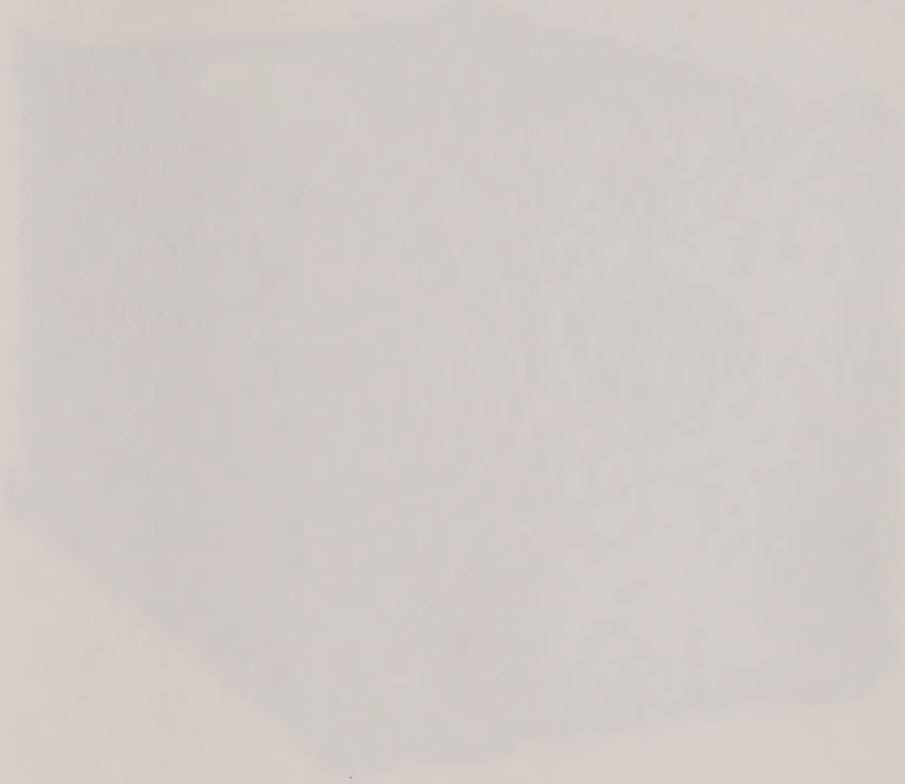


P903 PLUG-IN OUTPUT UNIT

The P903 Plug-in Output Unit is designed for use with DATAPULSE Model 200, 103, and 202 test instruments. The P903 features simultaneous positive and negative output pulses with very fast rise and fall times (less than 5 nanoseconds), and pulse width variation control from less than 50 nanoseconds to 2000 microseconds.

This manual provides detailed instructions for the use and maintenance of your Model P903. A thorough understanding of its contents will contribute to full utilization and longer life of this unit.



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SECTION I

SPECIFICATIONS

1.1 INPUT TRIGGER REQUIRED

Negative 2-volt pulse, dc coupled from ground, with a source impedance of less than 100 Ω; 10 nanosecond rise time; 20 nanosecond width; 0.2μsec. minimum trigger separation.

1.2 OUTPUT PULSES

Pos. and Neg. provided simultaneously, dc coupled with baseline effectively at ground. Outputs may not be connected to loads other than ground level or to other signal sources without observing special precautions.

Any combination of two P903 output units may be mixed without causing damage to the units.

1.2.1 Pulse Delay

The leading edge of the pulse outputs and transition times of the NRZ outputs are delayed from the input set and/or reset triggers by approximately 25 nanoseconds.

1.2.2 Pulse Duration

Both outputs continuously variable simultaneously, from less than 50 nanoseconds to 2,000 μsec, covered in 13 calibrated steps (1, 2, 5 series) plus uncalibrated vernier. Also provided is a non-return-to-zero output when used with 200 series digital word generators. Step control accuracy is approximately 10%. Circuit recovery time allows operation up to at least 50% duty cycle.

1.2.3 Amplitude (Both Pos. & Neg. Pulses)

When output is not loaded, amplitude is continuously variable from approximately 5 to 9 volts. When output is terminated with 50 ohms to ground, amplitude is continuously variable from approximately 2.5 to 5 volts.

Positive and negative outputs have separate amplitude controls, and output impedance is approximately constant over the full amplitude range.

1.2.4 Transition Times

The leading edge and trailing edge transition times of the P903 are both less than 5 nanoseconds when operating into a 50 ohm load. When no load is used, transition times may increase due to capacitive loading.

1.3 POWER REQUIRED

+ 10 volts dc at 175 ma

- 10 volts dc at 300 ma

- 5 volts dc at ± 10 ma

All power required is available from standard DATAPULSE instruments using plug-in output units.

1.4 CONSTRUCTION

Light gold anodized front panel with etched black and red markings. The P903 plugs into space provided in standard DATAPULSE instruments, mating with a 24-contact blue ribbon female connector. Front panel output connectors are BNC type. Size is 4 3/8" H x 4 3/4" W x 6 9/16" D.

1.5 ACCESSORIES

Furnished with one operation and maintenance manual section, for insertion in basic instrument manual.

Coaxial cables (specify impedance) and Type 2002 50-ohm power terminations are available as optional accessories.

SECTION II

OPERATING INSTRUCTIONS

2.1 DESCRIPTION OF CONTROLS AND CONNECTORS

2.1.1 Pulse Duration - Vernier

Simultaneously controls the positive and negative output pulse widths. Step calibration is made at the factory with the vernier control fully clockwise.

The vernier control allows an approximately linear, continuous decrease in pulse duration, down to a factor of approximately one-third.

2.1.2 Amplitude - POS. PULSE

Allows smooth variation of the positive polarity output pulse amplitude.

2.1.3 Amplitude - NEG. PULSE

Allows smooth variation of the negative polarity output pulse amplitude.

2.2 PLACING IN OPERATION

Plug the P903 into its parent unit, pressing firmly to insure that the connectors make proper contact. Tighten the locking mechanisms. Connect the power cord to the rear of the instrument and to the power line and turn the unit POWER switch ON.

Make sure the spacing of the input triggers to the P903 is not less than approximately twice the PULSE DURATION.

Observe the output pulse and vary the controls, observing their operation as explained in Paragraph 2.1 above.

If the P903 seems to be operating improperly, the troubleshooting section of this manual will be of considerable help in locating the trouble.

2.3 OPERATING CONSIDERATIONS AND SPECIAL APPLICATIONS

2.3.1 Mixing

The output circuitry in the P903 has been designed so that shorting the outputs to ground will not be injurious to the unit.

The outputs of two P903's may be mixed together on a single line without harming the unit.

2.3.2 Scope Overshoot

The fast rise times of the P903 make it a valuable tool when checking for overshoot in synchroscope amplifier circuitry.

To check the output waveform on a P903, one should use a sampling scope or other instrument with a bandpass of over 500 megacycles.

SECTION III

THEORY OF OPERATION

Consider the P903 as three basic circuits:

(1) A Gate Generator

(2) A Positive Pulse Amplifier and Variable Voltage Power Supply

(3) A Negative Pulse Amplifier and Variable Voltage Power Supply.

The gate generator consists of a monostable multivibrator, with emitter follower cross coupling on one side to improve output waveshape.

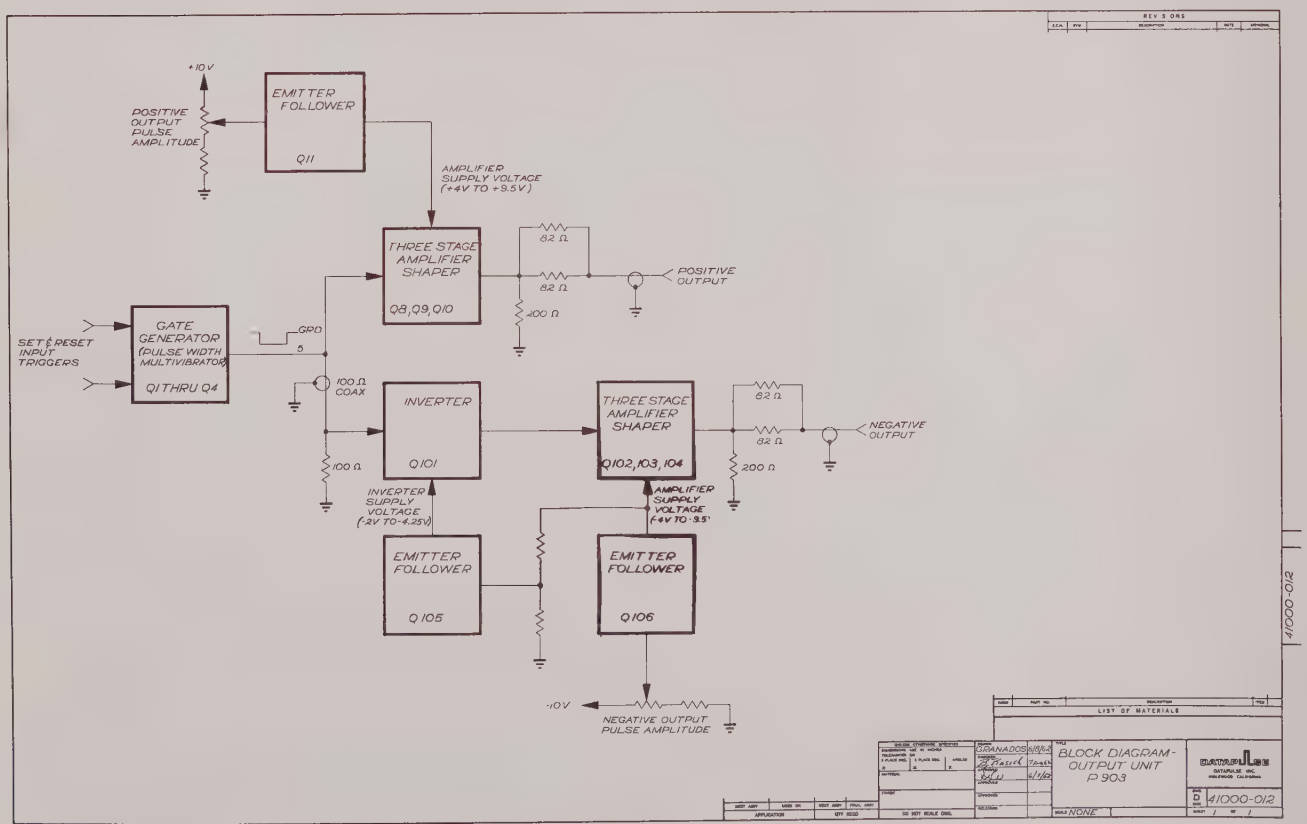
The gate is formed into acceptable output waveforms by several stages of inverting over-driven amplifiers, in the case of both the positive and negative pulses.

The output amplitudes are varied by varying the supply voltages to the amplifying stages.

Output Impedance Note:

Upon inspection of the operation of the output circuitry (see schematic diagram in the rear of the manual), one will see that the output impedance is not 50 ohms on the trailing edge of the output waveform; it is approximately 250 ohms. This may cause mismatching problems when using non-terminated 50-ohm coaxial system with the P903. This high impedance trailing edge will also explain a slower trailing edge transition time when the unit does not have a proper load on its output.

The leading edge and pulse top output impedance is actually slightly more than 41 ohms.



MAINTENANCE INSTRUCTIONS

4.1 PREVENTIVE MAINTENANCE

4.1.1 Recalibration

The P903 contains very stable circuitry and the unit will provide many hours of trouble-free operation. To insure continued reliability, the power supply voltages, and pulse width circuitry should be checked for calibration after each 500 hours of operation, or at least every six months if the unit is used intermittently.

4.1.2 Visual Inspection

Conduct visual inspections at regular intervals, preferably every few months. Check for possible circuit defects including loose or broken connections; scorched printed circuit boards, wires, or resistors; and loose nuts and bolts.

4.1.3 Component Replacement and Soldering Connections

When replacing transistors, diodes, or other heat-sensitive devices, a heat sink should be used between the device and the soldering iron tip. A pair of long-nosed pliers may be used in most cases. Special care must be taken, when soldering printed circuit wiring to avoid overheating and subsequent separation of the printed circuit from its epoxy material.

4.2 TROUBLESHOOTING PROCEDURE

The first points to check after most malfunctions are the power supply voltages.

The voltages used for the P903 should be adjusted to within ± 5% of their specified value. Note that the voltages must be adjusted in a certain sequence due to referencing.

The sequence which must be used is as follows:

(1) +10v

(2) -10v

(3) -5v

The following table should prove useful in isolating malfunctions within the unit. Once the area of trouble is isolated, the waveform photos and schematic diagrams in this manual may be used to locate the defective components.

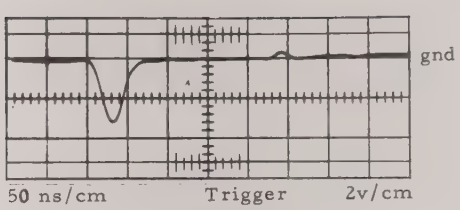
TABLE 4-1

TROUBLESHOOTING CHECKS

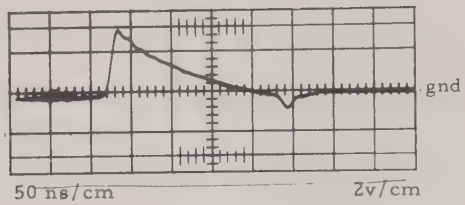
MALFUNCTION	POSSIBLE CAUSE
NO OUTPUT (EITHER POLARITY)	1. No set input trigger. 2. Pulse width multivibrator inoperative (Q1 through Q4).
NO OUTPUT (POS. POLARITY)	1. Amplifier inoperative (Q8, Q9, Q10). 2. No voltage (+10v) to Q11. 3. Q11's emitter open circuited.
NO OUTPUT (NEG. POLARITY)	1. Amplifier inoperative (Q101 through Q104) 2. No voltage (-10v) to Q106. 3. Q105's or Q106's emitter open circuited.
BASELINE OF OUTPUT PULSE NOT AT GROUND LEVEL (EITHER POLARITY)	1. Driver (Q103 or Q9) to output transistor (Q104 or Q10) has too high a saturation voltage. 2. DC supply voltages not properly adjusted.
NRZ OPERATION FAULTY (WHEN USED WITH MODEL 200 AND 202 DIGITAL WORD GENERATORS ONLY)	1. No reset trigger input.

TABLE 4-2

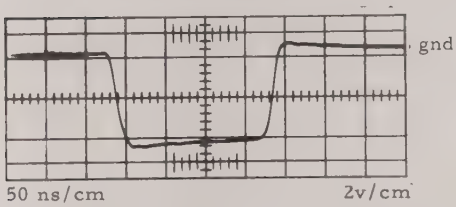
CHARACTERISTIC WAVEFORMS



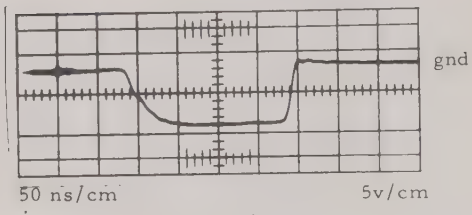
Set or Reset/Inputs
(Pin 16 or Pin 18 of 24-pin
blue ribbon connector)



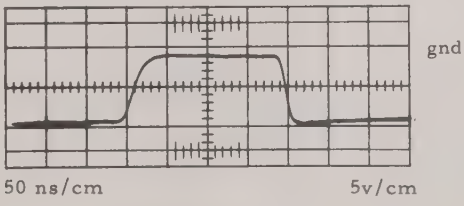
Base of Q3



Emitter of Q2

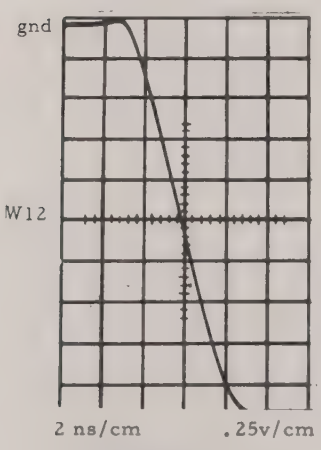


Collector of Q9

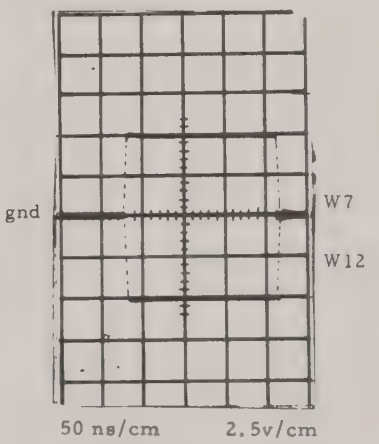


Collector of Q102

The waveforms shown above were taken from a Tektronix Type 581 Oscilloscope with a Dual Trace (Type CA) Plug-in. Those shown below were taken from a Hewlett-Packard Type 185B Sampling Oscilloscope.

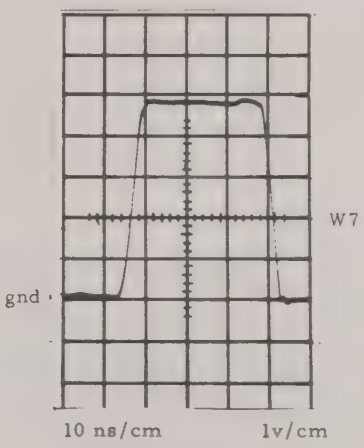


Leading Edge of Neg.
Output Pulse



W7: Pos. Pulse Output
W12: Neg. Pulse Output

Approx. Symmetry of
P903 Outputs



Pos. Pulse Output
Showing Min. Possible
Pulse Width

4.3 CALIBRATION PROCEDURE

4.3.1 Equipment Required

DC oscilloscope--Tektronix 541, Hewlett-Packard 150A or equivalent.

DC voltmeter--Any voltmeter with greater than 1000 ohms per volt sensitivity, calibrated to ±5%.

4.3.2 Power Supply

The power supply (and adjustments thereto) for the P903 are located in the instrument with which the P903 is used. All voltages should be within ±5% of the stated values.

4.3.3 Pulse Duration - μsec. (A Tektronix Type 541 oscilloscope or equivalent is needed for this calibration)

On the right side card of the P903 there are three screwdriver-adjust controls, labeled "5 μs", "2 μs", and "1 μs".

Set the oscillator switch in the main instrument for 100 kc or less and the pulse delay for minimum delay.

Set the PULSE DURATION switch to 5 microsec. and turn the vernier control fully clockwise and leave it there throughout the rest of the calibration.

Observe the positive or negative output pulse for measurement.

Adjust the 5 μs calibration control for 5 μsec. pulse width.

Turn the PULSE DURATION switch to 2 microsec. and adjust the 2 μs calibration control for 2 μsec. pulse width.

Turn the PULSE DURATION switch to 1 microsec. and adjust the 1 μs calibration control for 1 μsec. pulse width.

No further calibration should now be necessary; however there are trimmer condensers on the PULSE DURATION switch to adjust the .5 μsec. and 2 μsec. ranges if further calibration accuracy is desired on these ranges.

4.4 SPECIFICATIONS VERIFICATION

Allow a 30 second warm up period before making tests. The following equipment, or its equivalent, is necessary.

a) A 5mc trigger source with ± 10 ohms, -10 ohms, & -5ohms at required currents. (DATAPULSE Model 202M) (DATAPULSE Model 200M is not capable of testing the 5 mc operation & Model 103M will not check the NRZ operation, but either may be used with these limitations in mind).

b) Syncroscope (Tektronix 543 with Type L Preamplifier.

c) Sampling scope (HEWLETT-PACKARD 185B with 187B Plug-in Amplifier.)

d) Type 2002A DATAPULSE 50 ohms, 5w load.

e) BNC tee connector, UG-274/u.

IT IS ASSUMED THAT THE INSTRUMENT WITH WHICH THE P903 IS BEING USED FULLY MEETS THE REQUIRED SPECIFICATIONS AS TO POWER SUPPLY VOLTAGES AND TRIGGER INPUT WAVESHAPE.

TABLE 4-3

PULSE DURATION CALIBRATION CHECK

CLOCK RATE (REPETITION RATE)	PULSE DURATION	VERNIER	SCOPE SWEEP SPEED (per cm)	CORRECT PULSE DURATION [1] (cm)	TOLERANCE (cm)
0.1MC/S	0.2μs	cw	.05μs(.1, magx2)	4.0	±0.4
0.1MC/S	0.2μs	ccw	.05μs(.1, magx2)	1.0 or less	--
0.1MC/S	0.5μs	cw	.1μs	5.0	±0.5
0.1MC/S	1μs	cw	.2μs	5.0	±0.5
0.1MC/S	2μs	cw	.5μs	4.0	±0.4
0.1MC/S	5μs	cw	1μs	5.0	±0.5
10KC/S	10μs	cw	2μs	5.0	±0.5
10KC/S	20μs	cw	5μs	4.0	±0.4
10KC/S	50μs	cw	10	5.0	±0.5
1KC/S	0.1ms	cw	20μs	5.0	±0.5
1KC/S	0.2ms	cw	50μs	4.0	±0.4
1KC/S	0.5ms	cw	.1ms	5.0	±0.5
1KC/S	0.5ms	ccw	.1ms	less than 1.8	
0.1KC/S	1ms	cw	.2ms	5.0	±0.5
0.1KC/S	2ms	cw	.5ms	4.0	±0.4

[1] Pulse duration is measured from the 50% amplitude point on the leading edge of the pulse to the 50% amplitude point on the trailing edge of the pulse.

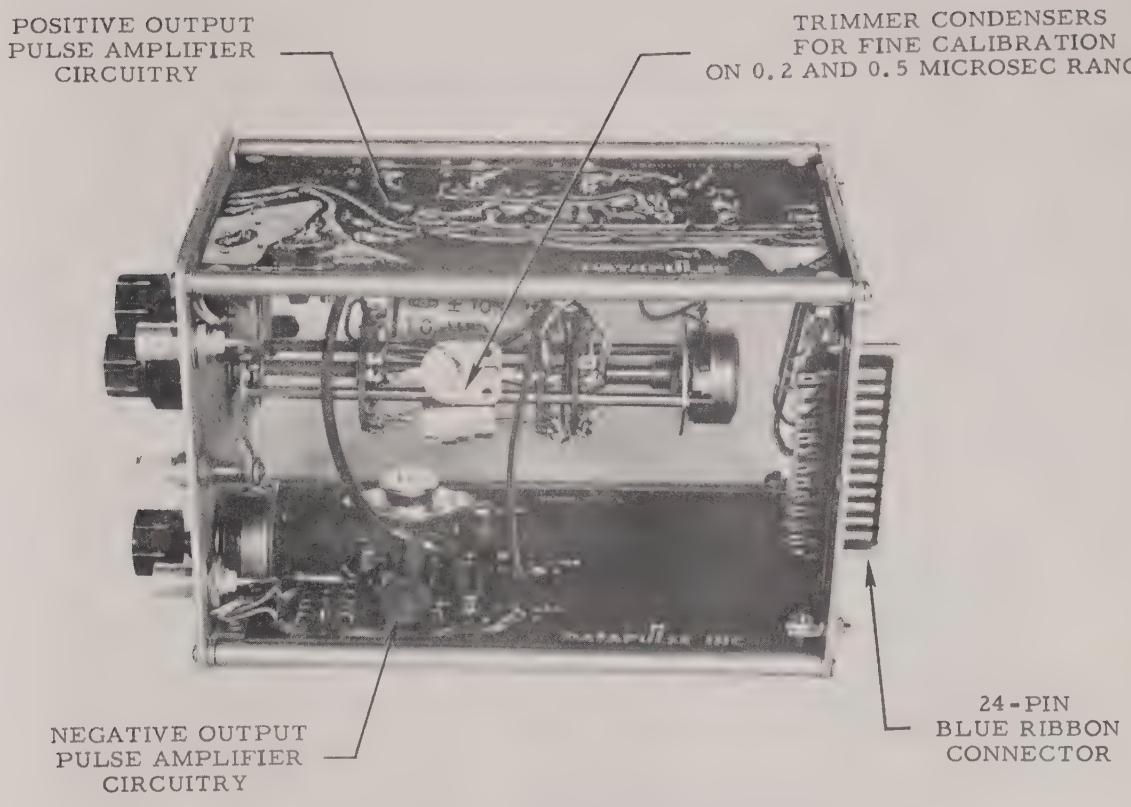


Figure 4-1. P903 Viewed from Bottom Side

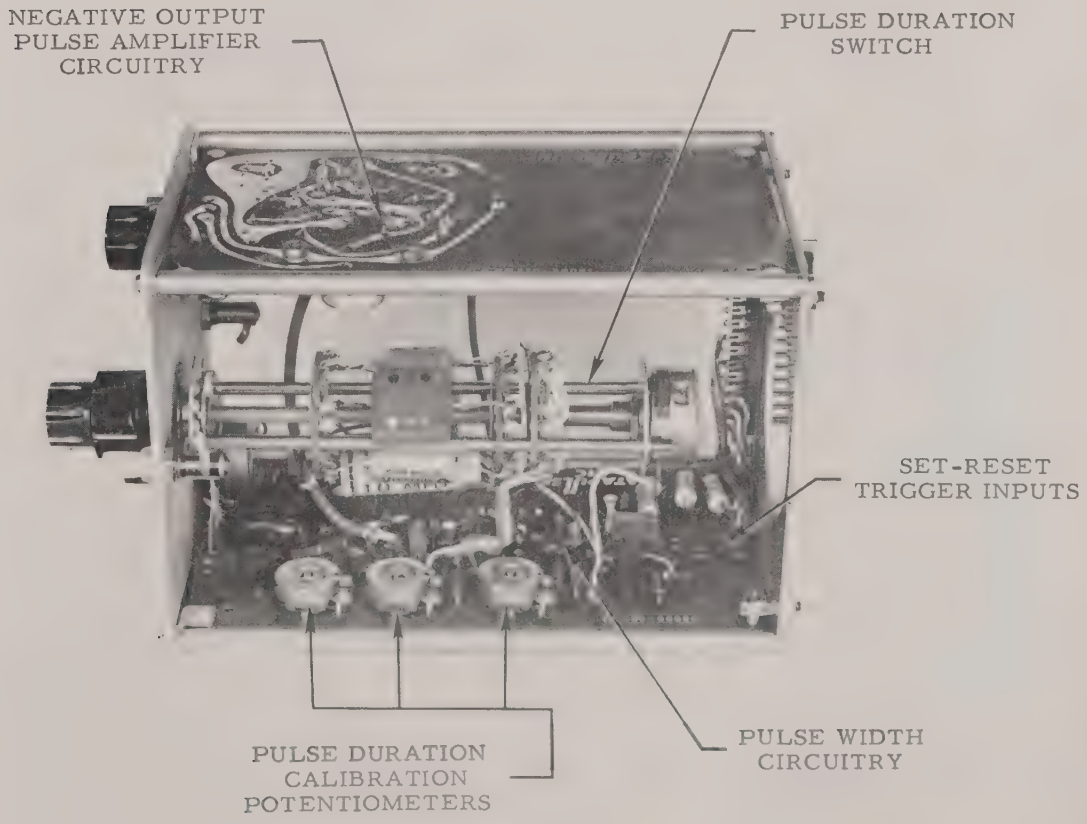


Figure 4-2. P903 Viewed from Top Side

4.4.1 Pulse Duration Plug the P-903 into one of the receptacles provided in its parent unit.

Turn power on.

Set CLOCK RATE (Repetition Rate) to 0.1 MC/S (VERNIER cw)

Program all switches on the 200 or 202 to the up (one) position.

Set PULSE DELAY to 0.2 MICROSEC, VERNIER ccw (do not actuate the ZERO DELAY switch on the 202.

Set PULSE DURATION to 0.2 μsec, VERNIER ccw.

Sync Scope (543) from the Sync Output of the main instrument (clock or reference sync).

Attach a 50ohm load to the NEG PULSE OUTPUT.

Turn AMPLITUDE controls fully cw.

View Neg. Pulse output (use a BNC tee connector at the 50 ohm load) at a sweep speed of .1μsec/cm; vertical sensitivity 2 volts/cm).

See Pulse Duration Settings (Table 4-3).

4.4.1.1 NRZ Operation: Program switches 1 and 3 to the down (zero) position (use the programming switches which correspond to the channel output being used).

Sync Scope on Bit One sync output.

Set PULSE DURATION to NRZ.

Set PULSE DELAY VERNIER fully ccw, (actuate the ZERO DELAY switch).

Set CLOCK RATE to 1 KC/S, VERNIER cw.

Set sweep speed to .2msec/cm.

Verify a negative pulse, 5 cm wide, (±10%) after a delay of 5 cm (±10%).

Set CLOCK RATE to 5 MC/S, VERNIER cw (2MC/S on the 200).

Set sweep speed to .1μsec/cm.

Program switch number 3 to the up (one) position.

Verify a positive pulse switch disappears when the number 1 switch is thrown to the up (one) position.

Verify the pulse width of 2 cm (±10%). (5 cm on the 200).

Program the number 1 switch to the up (one) position so that now all switches are in the same position.

4.4.1.2 Duty Cycle: Sync scope from clock or Reference Sync Output.

Set CLOCK (REPETITION) RATE to 2MC/S, VERNIER ccw.

Set sweep speed to .1 μsec/cm.

Set PULSE DURATION to 1 MICRO SEC, VERNIER ccw.

Line up the leading edge of the pulse with the far left side of the scope graticule.

Turn the PULSE DURATION vernier ccw until the Pulse Width is 5.0 cm.

Turn the CLOCK RATE (REPETITION RATE) Vernier cw until the leading edge of a second pulse lines up with the right hand side of the scope graticule. (50% duty cycle).

Verify that no perceptible change occurred in the pulse width of the first pulse when the above adjustment was made.

4.4.2 Pulse Amplitude

Verify neg. pulse amplitude of 2.5cm or more.

Turn NEG PULSE AMPLITUDE control ccw.

Set vertical sensitivity to 1 v/cm.

Verify a neg pulse amplitude of less than 2.5 cm.

Connect the 50Ω load to the POS PULSE OUTPUT jack and observe the Pos. Pulse. Verify a pulse width of 5cm.

Set vertical sensitivity to 2 v/cm.

Verify pos. pulse amplitude of 2.5 cm or more.

Turn POS PULSE AMPLITUDE control ccw.

Set vertical sensitivity to 1 v/cm.

Verify a pos pulse amplitude of less than 2.5 cm.

4.4.3 Rise and Fall Time

Set CLOCK RATE to 5MC/S (2MC/S on 200).

Set PULSE DURATION to 0.2 Microsec, VERNIER ccw.

Sync the sampling scope (185B) to the Clock or Reference Sync Output.

Observe the Pos Output Pulse and terminate it with the 50 ohm load.

Set scope sweep speed to 10nsec/cm, vertical sensitivity .5v/cm.

Adjust the PULSE DELAY Vernier until the pulse is centered on the scope.

Adjust both OUTPUT PULSE AMPLITUDE controls fully cw.

Adjust the pulse amplitude and/or scope vertical sensitivity vernier slightly until the pulse is just 10cm tall.

Set the scope time scale magnifier to x2.

Verify that the pulse transition times (leading edge and trailing edge) are less than 1 cm from the 10% to 90% points.

Set the time scale magnifier to x1.

Observe the Neg. Output Pulse and terminate it with the 50Ω load.

Adjust the pulse amplitude and/or scope vertical sensitivity vernier slightly until the pulse is just 10cm tall.

Set the scope time scale magnifier to x2.

Verify that the pulse transition times (leading edge and trailing edge) are less than 1cm from the 10% to 90% points.

This concludes the specification verification check.

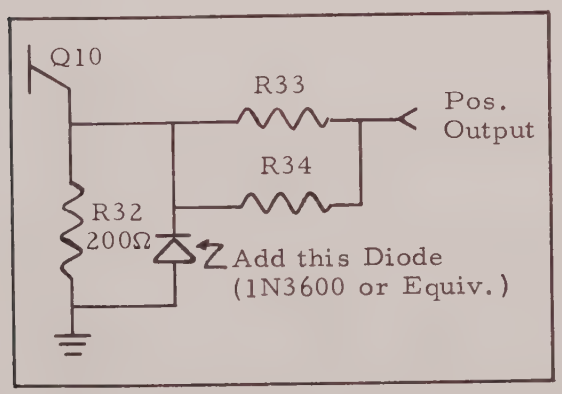
MIXING OUTPUTS OF TYPE P903 PLUG-IN UNIT

In certain applications, it is desirable to generate pulse output signals by mixing the outputs of Type P903 Plug In Units, as used with Model 103M Pulse Generator or Models 200M or 202M Data Generators. Utilization in this fashion is limited by the reverse voltage characteristics of output transistors.

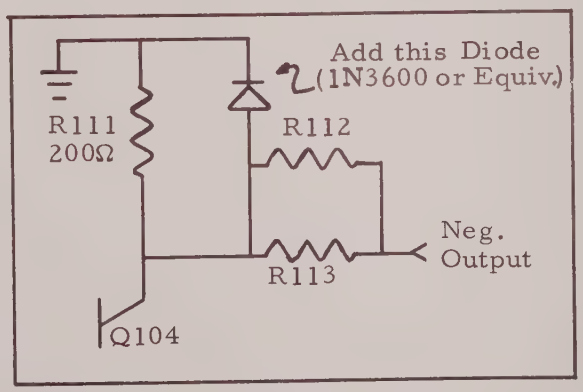
Mixing Same Polarity Outputs: Output transistor characteristics do not limit mixing of the same polarity output. However, it will be found (particularly in recent production utilizing faster rise time output transistors) that simply connecting output jacks together results in transmission line mismatch adequate to distort output signals. Therefore, when mixing same polarity output of Type P903 Plug In Units, each output should be connected to an impedance equalizing Tee-pad located at the load.

Mixing Opposite Polarity Outputs: Reverse voltage characteristics of output transistors do not allow tying together opposite polarity outputs of Type P903 units. The previously offered Type 2301 mixer units allowed the mixing of opposite polarity outputs, but with a 50% reduction in output amplitude. This mixer, also previously utilized for mixing outputs of Type P901 units, is no longer being offered. Mixing of opposite polarity outputs may be accomplished, however, provided that output transistor stages are modified as follows:

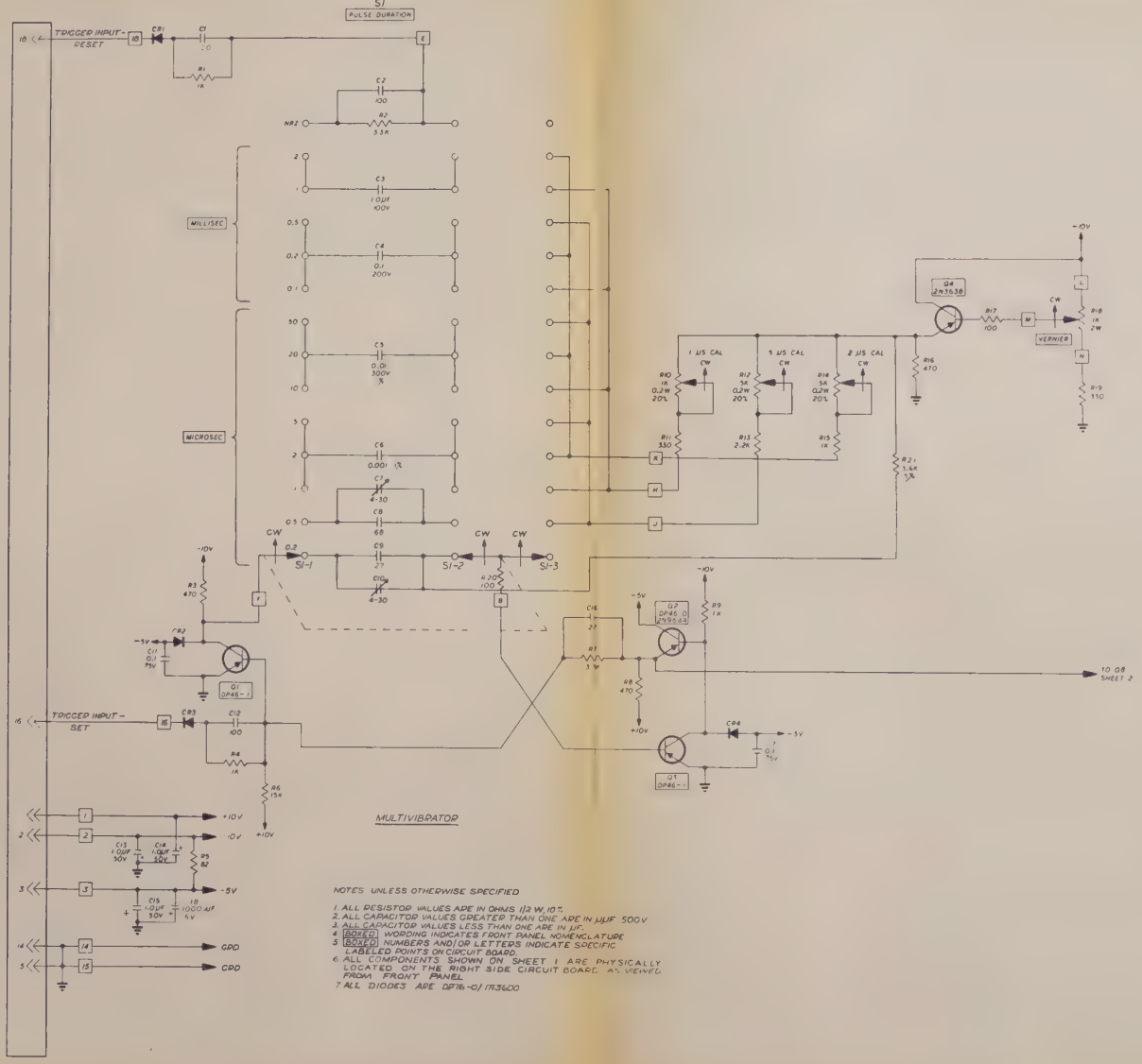
Modification of Positive Output Stage



Modification of Negative Output Stage



Opposite polarity outputs of Type P903 Output Units modified above may be directly connected together (preferably via a Tee-pad at the load) with minimum loss of output amplitude.



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS 1/2 W, 10%.
2. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µµF 500V
3. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
4. BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE
5. BOXED NUMBERS AND/OR LETTERS INDICATE SPECIFIC LABELED POINTS ON CIRCUIT BOARD.
6. ALL COMPONENTS SHOWN ON SHEET 1 ARE PHYSICALLY LOCATED ON THE RIGHT SIDE CIRCUIT BOARD AS VIEWED FROM FRONT PANEL
7. ALL DIODES ARE DP16-01 OR 1N3600

REV. & ECNO				
42	4	1) CHANGED C1 FROM 27 TO 100 PF 2) CHANGED R9 FROM 470Ω TO 1K 3) CHANGED C89 FROM 82 TO 68PF		B Burns
37	B	SEE SHEET 2		B Burns

SEE SHEET 2 FOR ALL OTHER CHANGES

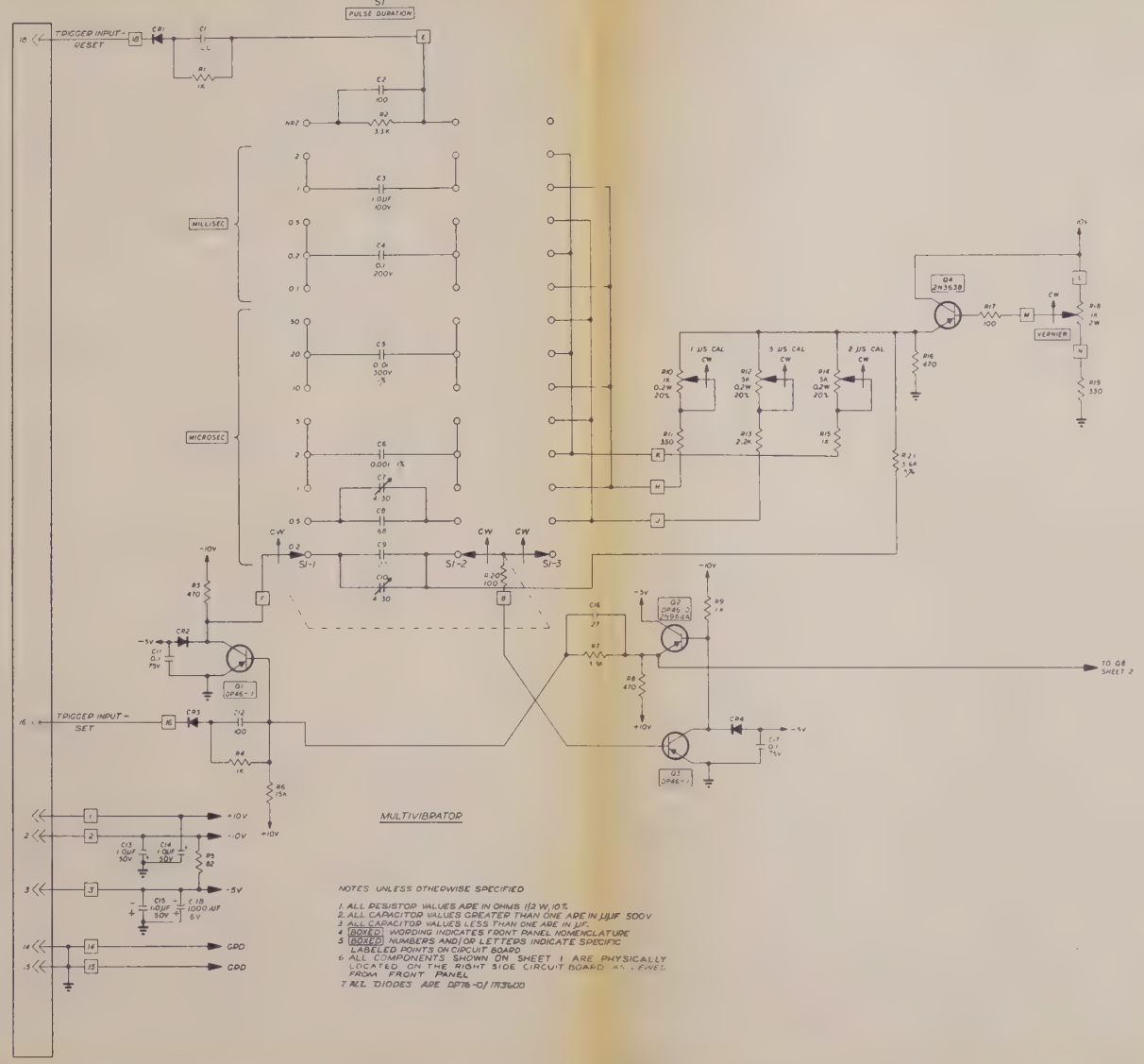
FOR PART REQUIREMENTS SEE LIST OF MATERIAL

SEE SHEET 2

FIRST USED	LAST USED	UNITTED	ASSOCIATED DRAWINGS USED ON	P903
REFERENCE DESIGNATION			APPLICATION	

B BUSICK		SCHEMATIC — PULSE WIDTH CIRCUITRY	DATAPULSE INC.
DRAWN			
CHECKED			
ENGR			
MFG			
SIZE D	DWG NO. 40000-018		
SCALE NONE	LOOSE 5033	SHEET 1 OF 2	

40000-018



NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS 1/2 W, 10%.
2. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µµF 500V
3. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
4. BOXED WORDING INDICATES FRONT PANEL NOMENCLATURE
5. BOXED NUMBERS AND/OR LETTERS INDICATE SPECIFIC LABELED POINTS ON CIRCUIT BOARD
6. ALL COMPONENTS SHOWN ON SHEET 1 ARE PHYSICALLY LOCATED ON THE RIGHT SIDE CIRCUIT BOARD AS VIEWED FROM FRONT PANEL
7. ALL DIODES ARE DP76-01 1N3600

REV	ZONE	DESCRIPTION
AC	A	1. CHANGED R17 FROM 100 TO 470 2. CHANGED R8 FROM 470 TO 680 3. CHANGED C8 FROM 62 TO 68PF
37	B	SEE SHEET 2

SEE SHEET 2 FOR ALL OTHER CHANGES

FOR PART REQUIREMENTS SEE LIST OF MATERIAL

REFERENCE DESIGNATION	ASSOCIATED DRAWINGS	USED ON
P903		

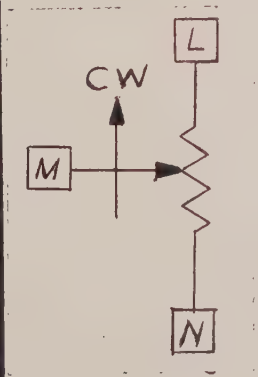
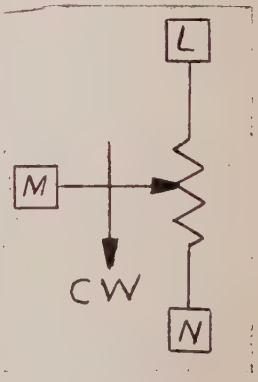
SCHEMATIC — PULSE WIDTH CIRCUITRY

DRAWING NO. 40000-018

SHEET 1 OF 2

40000-018C

ADDENDA AND ERRATA

E. O. NO.	EFFECTIVE DATE	DWG. NO.	CHANGE
778	11-4-65	J40000-018C Sheet 1 Sheet 2	Schematic - Pulse Width Circuitry 1. Add note 8 to general notes. Asterisk indicates component value. May be factory adjusted. 2. Add an asterisk next to ref. des. R21. 3. Change Q8 to DP63-3, was DP63-0. 4. Change Q103 to DP63-4, was DP63-0.
887	4-14-66	J40000-018C Sheet 1 Sheet 2	Schematic - Pulse Width Circuitry 1. Change Q2 from DP46-0 to DP60-6. 2. Change Q101 and 102 from DP46-0 to DP60-6.
2050	7-6-66	J40000-018C Sheet 1	Schematic - Pulse Width Circuitry Change R19 from 330Ω, 1/2w, 10%, P/N 10021-331 to 270Ω, 1/2w. 10%, P/N 10021-271.
2021	8-26-66	Transistor Equiv.	SM 1330, P/N 12685-004 is an acceptable substitute for DP63-6, P/N 22635-006.
2081	8-26-66	Transistor Substitution	2N2102, P/N 12685-005 may be used in lieu of 2N2270, P/N 12695-001.
2099	9-13-66		Change calibration procedure from -5 volts to -6 volts.
2288	6-8-67	J40000-018C Sheet 1	Schematic - Pulse Width Circuitry Reverse direction of arrow on R18. WAS  IS 

DATAPULSE
DIVISION OF DATAPULSE INCORPORATED

SERVICE BULLETIN
NO. 1-65

SEMICONDUCTOR REPLACEMENTS

(Applicable to all Datapulse Models except the Model 100 and 102)

Datapulse makes extensive use of house labeled semiconductors, superseding or used in place of commercial equivalents. In most cases, these are procured against relaxed or actual commercial equivalent specifications, and commercial equivalents as listed below may, therefore, be used as replacements.

DATAPULSE TYPE NO.*	DATAPULSE PART NO.	COMMERCIAL EQUIVALENT
Diodes:		
DP16-0	22164-000	1N3600
DP16-1	22164-001	1N3604
DP16-2	22164-002	HPA1003
DP19-0	22194-000	1N2070
DP19-1	22194-001	1N4002
DP19-6	22194-006	1N2071
Transistors:		
DP43-0	22435-000	2N984
DP46-0	22465-000	2N964A
DP46-1	22465-001	None**
DP59-0	22595-000	2N1132A
DP60-0	22605-000	2N2411
DP60-1	22605-001	None**
DP60-2	22605-002	2N2904 or 2N3133
DP60-3	22605-003	2N2894
DP60-4	22605-004	2N3209
DP60-5	22605-005	FT1702
DP60-6	22605-006	2N3640
DP63-0	22635-000	2N2369 or 2N2501
DP63-1	22635-001	2N3723
DP63-2	22635-002	None**
DP63-3	22635-003	2N2369A
DP63-4	22635-004	2N3646 or 2N3605 or MPS3646
DP63-6	22635-006	2N2270

*Some earlier publications show Type No. without the dash.

**Replacements for the following items should be procured from Datapulse:

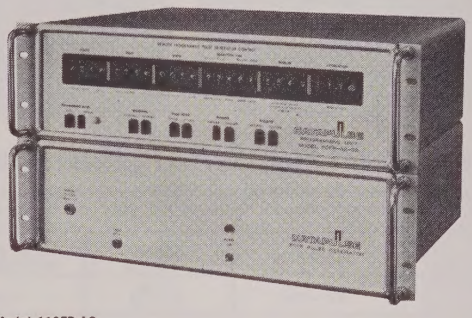
DP46-1 is selected from 2N2964A for high Beta.
DP60-1 is selected from 2N2894 for high V eco.
DP63-2 is selected from 2N914 for tighter Beta tolerance.

6/15/67

DATAPULSE®

a galaxy of pulse instruments

Model 101 8½"W x 3½"H x 11"D



Model 110FP-A2

Model 110A

Model 111

DATAPULSE/Pulse Generators

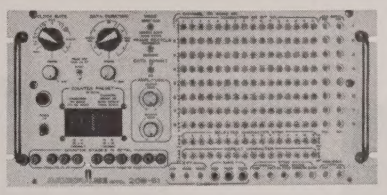
Datapulse offers a full line of fast pulse generators, providing a wide range of rep. rates and output powers. Relay rack mount and 115/230V, 50/60 cycle power is available for all units. Inquiries are invited on modifications and special requirements such as automatic programming and multipulse systems, etc.

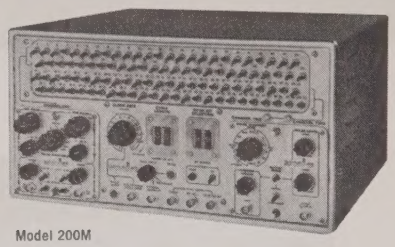
	MODEL	REP. RATE	DELAY	DURATION	RISE & FALL TIMES	OUTPUT	PRICE
	100	5Hz — 500KHz (1 MHz Ext. Trigger)	0.2μs—100ms	0.1μs—100ms	to 30ns rise to 40ns fall	+35V, —80V open cct, ±10V into 50Ω	$ 345.00
	101*	10Hz — 10MHz sgl. or dbl. pulse	40ns to 10ms	35ns to 10ms	Typically <5ns rise <7ns fall (Max. 10ns)	Simultaneous ±10V into 50Ω	$ 395.00
	102	2Hz — 3MHz	0.2μs—10ms	50ns—10ms	variable 10-500ns	±50V into 50Ω	$ 720.00
	102-S1A			Like 102 but offers variety of multipulse formats.			$1650.00
	102-S3	Like 102 except also provides two pulses per cycle at rep rates to 800KHz, with separation variable from 0.5μs to 10ms.					$ 920.00
	102-S4	Like 102 except provides up to 10ms delay or advance of main pulse and five-turn control resolution on delay.					$ 920.00
	103M*	<5Hz — 5MHz	0.1μs—5ms, two channels provided	Outputs are provided by plug-in Output Units (see below) — 1 reqd. for single pulse, 2 for double pulse.			$ 880.00
	106A*	10Hz — 12MHz sgl. or dbl. pulse	<40ns—5ms	<25ns—5ms	separately variable 10ns—1ms	Simultaneous ±12V into 50Ω	$ 950.00
	108*	10Hz — 10MHz	0—5ms	<25ns—5ms	Variable 7—50ns	±50V into 50Ω	$1480.00
	108L*	10Hz — 10MHz	0—5ms	<30ns—5ms	Separately variable linear rise 12ns—12.5μs	±50V into 50Ω	$1980.00
	109*	4Hz — 40MHz sgl. or dbl. pulse	10ns advance to 50ms delay	10ns—50ms	<5 nanosec	Simultaneous ±10V into 50Ω	$ 690.00
	110A*	4Hz — 40MHz sgl. or dbl. pulse	10ns advance to 50ms delay	10ns—5ms	Separately variable linear 4ns—500μs	Simultaneous ±10V into 50Ω DC offset to 10V	$1250.00
	111*	4Hz — 40MHz sgl. or dbl. pulse	15ns advance to 50ms delay	8ns to 0.5ms	Separately variable linear 2ns to 500ns rise 3ns to 500ns fall	±5V into 50Ω DC offset to 5 volts	$1480.00
Programmable	110FP*	Like 110A except allows remote control and/or automatic programming of all pulse parameters except amplitude.					$2530.00
Programmable	110FP-A2*	Provides manual control of programmed functions or allows programming from parallel logic lines of all parameters, including amplitude.					$3590.00
Programmable	G2*	Incorporated in 110FP-A2, also available separately, for control of pulse amplitudes. Allows attenuation to be varied from 0—39.9 dB in 0.1 dB steps.					$ 920.00
Programmable	250*	0.2μs — 1599ms period	0—159.9ms	0.1μs—159.9ms	10ns to 15V 50ns to 50V	±0.1—50V into 50Ω	$7210.00
			Timing and amplitude automatically programmable from BCD logic level lines. Timing derived from 0.005% accuracy 10Hz clock.				

*Fully solid-state instrument

Model 201 8½"W x 3½"H x 11"D

Model 208-S1





Model 200M

DATAPULSE/Digital Data Generators

Solid state off-the-shelf digital test instruments for high-speed simulated serial data, serial words, and pulse programs for general logic and systems development and magnetic memory and tape equipment design and test. Basic units may be economically modified for added channels for special program lengths.

MODEL	CLOCK RATE	SERIAL BITS/WD	NO. OF CHANNELS (BITS/CHARACTER)	OUTPUT	OTHER FEATURES	PRICE
200M	2Hz–2MHz	1–100 or 1–50	1 or 2	Outputs are provided by plug-in Output Units (see below) 1 req'd for 1 channel, 2 req'd for 2 channel use.	Selectable sync bit, Single word command	$3710.00
202M	5Hz–5MHz	16	2		Each channel may be delayed 0.1μs–5ms from clock.	$1720.00
201	to 10MHz	16	1	Simultaneous and complementary NRZ outputs to 10V, variable baseline offset to ±10V.	Provides RZ formats when triggered from async-gated pulse generator.	$680.00
202M-S1	Like Model 202M except also providing single word command capability and last bit sync output.					$2200.00
203	10Hz to 20MHz	1–100 or 1–50	1 or 2	±5V into 50 ohms variable duration 10ns to 5ms or NRZ	Variable delay 0–50ms for NRZ or variable width; bit and word repeat modes, word command & frame command, PCM mode.	$5700.00
206	2Hz–2MHz	16 fixed plus bits or pair repeats	6	+12V from 100Ω programmed triggers.	Selected sync. from any combination of intervals	$3590.00
206M	2Hz–2MHz	1–100	6	+6V from 100 ohms	Independent delay, width, and amplitude	$7170.00
208	5Hz–5MHz	1 to 16 plus variable repeats	8	6V into 50 ohms RZ or NRZC Variable width optional	Manual or triggered single frame	$6680.00
208-S1	Same as 208, except provides simultaneous positive and negative outputs and pulse duration control from 0.5μs to 5ms.					$7460.00
215C	1Hz–1MHz	Independently selectable word lengths for sync. and data words 1–32 bits.	1 PCM channel. 3 independent word types: sync, common and special frames to 512 words.	True and complement variable amplitude and lower level from 1 to 12 volts from 50 ohms, RZ, NRZ and bi-phase.	Provides for data perturbation and a reference data output (fixed output level 12 volts from 50 ohms). Common data word may be externally programmed. Special data word may be inserted in any word position except the first.	$4750.00

DATAPULSE/Plug-in Output Units

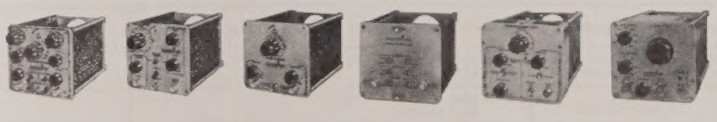
Datapulse solid state plug-in output units provide a wide choice of output characteristics from a single basic instrument, including very fast rise time, high power, variable waveform, selectable DC levels, and audio signal modulation. Units are interchangeable. (For use with Models 103M, 202M, and 200M)

TYPE	DURATION	RISE TIME	OUTPUT	OTHER FEATURES	PRICE
P901	50ns–2ms or NRZ*	Variable <20–> 300ns	Simultaneous ±15V into 50Ω	Current source, separate controls for ±outputs. Outputs may be mixed.	$570.00
P902	2μs–50ms or NRZ*	Approx. 0.1μs	Upper level 1 to 15V lower level –1 to –15V, from 600Ω	On-off modulates external carriers (to 20kc) providing up to 16V p–p, from 600Ω	$470.00
P903	50ns–2ms or NRZ*	<5 nanosec.	Simultaneous ±5V into 50Ω	Outputs may be mixed	$270.00
P904	<0.2μs	<50 nanosec.	±15V or ±5V into 50Ω	Two channels provided i.e., only 1 unit req'd. for two channel instrument	$185.00
P905	50ns–500μs	Variable <20ns –1μs	±25V into 50Ω	5% waveform aberrations	$610.00
P906	2ns–200ns	<1ns	±10V into 50Ω	Two units with Model 103M provide double pulse operation	$980.00

*NRZ OUTPUT IS PROVIDED ONLY WHEN USED WITH MODELS 200M, 202M, or 202M-S1.

PRICES AND DATA SUBJECT TO CHANGE WITHOUT NOTICE.
PRICES ARE DOMESTIC LIST, F.O.B. CULVER CITY, CALIFORNIA.

P901 P902 P903 P904 P905 P906



DATAPULSE®

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DATAPULSE • NESCO INSTRUMENTS • DE MORNAY-BONARDI • KRS INSTRUMENTS

WARRANTY

Datapulse Incorporated warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, transistors, fuses or batteries which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

Instruments returned under this Warranty will not be accepted at the Datapulse plant without prior authorization by a Datapulse representative or by the service manager of Datapulse Incorporated.

Datapulse Incorporated reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of Datapulse Incorporated and Datapulse Incorporated neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of Datapulse Incorporated instruments.

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